

CLAIMS

WHAT IS CLAIMED IS:

1. A seismic source system comprising:
 - a buoy comprising:
 - an operating system;
 - a seismic wave production device operated by the operating system;
 - a placement system;
 - a buoy communications system; and
 - a dynamic position locating system generating a position signal indicating the location of the buoy; and
 - a remote control system in remote communication with the buoy through the buoy communications system.
2. The seismic source system of claim 1 where the buoy further comprises the seismic wave production device position being controlled by a winch engaged with an arm extending from the buoy.
3. The seismic source of claim 1 where the buoy further comprises more than one seismic wave production device, each seismic wave production device position being controlled by a winch engaged with an arm extending from the buoy.
4. The seismic source device of claim 1 where the seismic wave production device comprises an air gun.
5. The seismic source device of claim 1 where the operating system further comprises an air storage vessel charged by compressor controlled by a controller, the seismic wave production device comprising an air gun powered by the air storage vessel.
6. The seismic source device of claim 1 where the placement system further comprises a anchor winch attached to an anchor by an anchor line, the anchor winch being controlled by the

remote control system.

7. The seismic source device of claim 6 where the placement system further comprises a second anchor winch attached to a second anchor by a second anchor line, the second anchor winch being controlled by the remote control system.

8. The seismic source device of claim 1 where the buoy communications system further comprises a buoy telemetry system in remote communication with the remote control system.

9. The seismic source device of claim 1 where the remote control system further comprises a remote control telemetry system in communication with the buoy communications system.

10. The seismic source device of claim 1 where the dynamic position locating system further comprises a GPS system.

11. The seismic source device of claim 1 where the buoy further comprises an operating sensor.

12. The seismic source device of claim 1 where the operating sensor comprises a hydrophone.

13. A method of generating a seismic wave comprising:
controlling a placement system on a buoy with a remote control system to position the buoy, the remote control system communicating with the buoy through a buoy communications system;
controlling an operating system on the buoy with the remote control system; and
operating a seismic wave production device on the buoy with the operating system to produce a seismic wave.

14. The method of claim 13 further comprising:
generating a position signal with a dynamic position device on the buoy indicating

- the position of the buoy;
- transmitting the position signal through the buoy communications system to the remote control system;
- analyzing the position signal with the remote control system; and
- transmitting a placement signal from the remote control system to the buoy communications system to operate the placement system and move the buoy to a selected position.
15. The method of claim 14 further comprising:
- transmitting a signal indicative of the seismic wave as a function of time from the buoy to the remote control system using the buoy communications system; and
- transmitting the position signal at the time of generating the seismic wave through the buoy communications system to the remote control system.
16. The method of claim 13 further comprising operating a winch on the buoy connected to an anchor by an anchor line to move the buoy.
17. The method of claim 16 further comprising operating a second winch on the buoy connected to a second anchor by a second anchor line to move the buoy.
18. The method of claim 13 where controlling the operating system further comprises:
- charging a gas storage vessel on the buoy with a compressor;
- producing a seismic wave by releasing the gas from the gas storage vessel through an air gun on the buoy.
19. A seismic acquisition system comprising:
- a buoy comprising:
- an operating system;
- a seismic wave production device operated by the operating system;
- a placement system;

a buoy communications system;
a dynamic position locating system generating a position signal indicating the location of the buoy; and
a remote control system suitable for communicating with the buoy through the communications system; and
a seismic receiver located in a wellbore.

20. The seismic system of claim 19 where the seismic receiver is located on a drill string.
21. The seismic system of claim 19 where the seismic receiver is located on a wireline tool.
22. The seismic system of claim 19 where the seismic receiver is located on a well casing.
23. The seismic system of claim 19 where the seismic receiver is located on a work string.
24. The seismic system of claim 19 where the seismic receiver is located in the annulus between a well casing and the borehole wall.
25. The seismic system of claim 19 where the seismic receiver is in communication with a data signal processor through a receiver telemetry system.
26. The seismic source system of claim 19 where the buoy further comprises the seismic wave production device position being controlled by a winch engaged with an arm extending from the buoy.
27. The seismic source of claim 19 where the buoy further comprises more than one seismic wave production device, each seismic wave production device position being controlled by a winch engaged with an arm extending from the buoy.

28. The seismic source device of claim 19 where the seismic wave production device comprises an air gun.
29. The seismic source device of claim 19 where the operating system further comprises an air storage vessel charged by compressor controlled by a controller, the seismic wave production device comprising an air gun powered by the air storage vessel.
30. The seismic source device of claim 19 where the placement system further comprises a anchor winch attached to an anchor by an anchor line, the anchor winch being controlled by the remote control system.
31. The seismic source device of claim 30 where the placement system further comprises a second anchor winch attached to a second anchor by a second anchor line, the second anchor winch being controlled by the remote control system.
32. The seismic source device of claim 19 where the buoy communications system further comprises a buoy telemetry system in remote communication with the remote control system.
33. The seismic source device of claim 19 where the remote control system further comprises a remote control telemetry system in communication with the buoy communications system.
34. The seismic source device of claim 19 where the dynamic position locating system further comprises a GPS system.
35. The seismic source device of claim 19 where the buoy further comprises an operating sensor.
36. The seismic source device of claim 19 where the operating sensor comprises a hydrophone.

37. A method of acquiring seismic data on an underground formation comprising:
- controlling a placement system on a buoy with a remote control system to position the buoy, the remote control system communicating with the buoy through a communications system on the buoy;
 - controlling an operating system on the buoy with the remote control system;
 - operating a seismic wave production device on the buoy with the operating system to produce a seismic wave;
 - transmitting a monitoring signal from the buoy to the remote control system using the communications system, the monitoring signal comprising the signature of the seismic wave as a function of time;
 - transmitting a position signal from a dynamic position device on the buoy through the communications system to the remote control system, the position signal indicating the position of the buoy at the time of generating the seismic wave;
 - receiving the seismic wave with a seismic receiver located in a borehole; and
 - generating a data signal indicative of the received seismic wave.
38. The method of claim 37 further comprising:
- generating a position signal with a dynamic position device on the buoy indicating the position of the buoy;
 - transmitting the position signal through the communications system to the remote control system;
 - analyzing the position signal with the remote control system;
 - transmitting a placement signal from the remote control system to the communications system on the buoy to operate the placement system and move the buoy to a selected position.
39. The method of claim 37 further comprising operating a winch on the buoy connected to an anchor by an anchor line to move the buoy.
40. The method of claim 39 further comprising operating a second winch on the buoy

connected to a second anchor by a second anchor line to move the buoy.

41. The method of claim 37 further comprising transmitting the data signal through a receiver telemetry system to a data signal processor.

42. The method of claim 41 further comprising analyzing the monitoring signal, the position signal, and the data signal with the data signal processor.

43. The method of claim 37 where controlling the operating system further comprises:
charging a gas storage vessel on the buoy with a compressor;
producing a seismic wave by releasing the gas from the gas storage vessel through an air gun on the buoy.

44. The method of claim 37 further comprising the receiver being located on a drill string and transmitting the data signal from the receiver through a telemetry system to a data signal processor.

45. The method of claim 37 further comprising the receiver being located on a wireline tool and transmitting the data signal from the receiver through a telemetry system to a data signal processor.

46. The method of claim 37 further comprising the receiver being located on a well casing and transmitting the data signal from the receiver through a telemetry system to a data signal processor.

47. The method of claim 37 further comprising the receiver being located on a workstring and transmitting the data signal from the receiver through a telemetry system to a data signal processor.

48. The method of claim 37 further comprising the seismic receiver being located in the

annulus between a well casing and the borehole wall and transmitting the data signal from the receiver through a telemetry system to a data signal processor.

49. The method of claim 37 further comprising producing the seismic wave, transmitting the monitoring signal, transmitting the position signal, receiving the seismic wave with a seismic receiver, and generating the data signal indicative of the received seismic wave during wellbore drilling operations.

50. The method of claim 37 further comprising producing the seismic wave, transmitting the monitoring signal, transmitting the position signal, receiving the seismic wave with a seismic receiver, and generating the data signal indicative of the received seismic wave during wellbore completion operations.

51. The method of claim 37 further comprising producing the seismic wave, transmitting the monitoring signal, transmitting the position signal, receiving the seismic wave with a seismic receiver, and generating the data signal indicative of the received seismic wave during wellbore production operations.